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ABSTRACT

In search of a method to increase the power of the educational experience for integrating student experience, many scholars have turned to the idea of interdisciplinarity. Apart from philosophical questions of values and epistemology there are operational problems of some significance. To meet them many advocates have proposed modifications in the organizational structure of colleges and universities. The thesis developed here is that modifications in the academic program, the curriculum, are more appropriate. In this way, it is proposed that most of the benefits can be obtained with minimal competition or confrontation in the organization. However, the design approach to curriculum modification is seen as essential. In this approach, curriculum is analyzed in terms of three main elements: content, context, and form. Examples are given of institutional efforts at curriculum change that have used one or more of the elements of the design approach. References are provided. (Author/MSE)

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Interdisciplinarity in General Education: Problems in Curriculum Design

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A -- An Essential Proposition:

Lodged in the dialogues and debates on interdisciplinarity is a supposition that the whole, in this case educational experience, can be made into something greater than the simple arithmetic sum of its parts. Stated so flatly this idea stand in contrast to the prevailing view in the natural sciences, that "naive assumption" of reductionism which holds that entities can be broken down into smaller and smaller elements until one universal essence is established to link all forms of knowledge (Scott 1979). The distinctive feature of the proposition on interdisciplinarity is that some form of action must be undertaken to achieve an integrated and superior whole. The natural processes of simple inquiry and mere exposure to organized knowledge will not produce unity. That action most often involves the rearrangement or reconstitution of the knowledge system and the process of knowing in ways that will stimulate multiplicative effects and eventually create a regenerative state (Jantsch 1972). The idea of interdisciplinarity usually finds easy acceptance and nearly universal recognition. The methods of action put forward to achieve its promised benefits, on the other hand, are a focus of vigorous controversy. It is the operational issues that are treated here, more specifically those which bear on the process of education rather than research or problem solving applications. In keeping with the theme of the

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conference the focus will be further sharpened to deal with operational issues in general education.

In the pages to follow we will first present observations about interdisciplinarity in contemporary life, the promises and caveats it conveys. To capture a sense of the range of program innovations already tried a brief classification of these efforts will be discussed. This information will provide a basis for the thesis of this paper, that the most effective operational approach to interdisciplinarity lies with the application of a design concept to existing curriculum. The concept of design will be made explicit in relation to education at the university level. Finally, it will be possible to describe a few recent programmatic introductions in U.S. institutions that reflect this approach.

B -- Observations on Interdisciplinarity.

1 -- General Education and Interdisciplinarity.

When the Center for Educational Research and Innovation surveyed twelve countries in 1970 to establish the state of interdisciplinary efforts they found most of the experimentation to be in the area of general education (CERI 1972). The survey also uncovered some clues as to why this emphasis has developed. The respondents reported that any move toward interdisciplinarity required some regrouping of disciplines and resources but there were no self-evident principles to guide that recombination. General education, out of its long tradition of exploring fundamental questions, does provide a climate in which principles of many kinds can be examined.

And today general education is enjoying a new vitality. Humanists and other primary spokesmen for the humane and liberal tradition

have moved away from their role of defending the bastions of literature and philosophy against the steady advance of science and practice. Rather suddenly, within the last two decades, it is the scientists, the medical practitioners, even the economists who are seeking links between the "hard" disciplines and the "soft." They are looking at general education with a new curiosity. In the U.S. it has been the interdisciplinary linkages between science and its gigantic offspring, technology, on the one hand and the humanities on the other that have produced action. At the Massachusetts Institute of Technology, Penn State, and other institutions with a solid scientific tradition integrated courses around the theme of "Science, Technology, and Society" have come into being.

There is much less attention in the U.S. to the other important relationship, the linkage between the social sciences and humanities, that you have selected for the theme of this meeting. It is a particular opportunity for me to share these events because you are probably moving ahead of scholars in the U.S. as you develop the theme. Not that an awareness of the issue is missing. Commentators often note the uncertain state of the social sciences today and prescribe a new view of the affinities to the humanities (Sherif in Kockelmans 1979). In summary, the conference, with its attention to interdisciplinarity in the setting of general education and with its particular focus on humanities and social science, introduces what is likely to be a major intellectual challenge in the next decade.

2 -- The Promises and Caveats of Interdisciplinarity.

All the major analysts of the subject of interdisciplinarity develop their own reasons for assigning importance to it. Jantsch,

Piaget, McGrath, Briggs, Michland, Sherif, Heckhausen, Husserl, Carnap, speak in their own clear way and will not be summarized here. However, there are some highly contemporary conditions that increase the value or at least the need for interdisciplinarity. They are offered as a personal selection not as a definitive summary. To begin with, the attention to the unifying force of the interdisciplinary view is a manifestation of those fundamental and complementary social processes, differentiation and integration, that were developed by the work of Allport, Bales, Parsons, and other sociologists. Interdisciplinarity is a manifestation of a fundamental intellectual and social process that can be encouraged for its intrinsic value.

Second, it helps address the "rift between the university and society" which Briggs (1972) sees as a major issue of the times. In various other ways the separation seems to widen: the analogies accepted in the university no longer seem to fit the world of problems and practice.

Third, interdisciplinarity, more than any other approach, promises to increase understanding many fold without requiring large additions of information or complex techniques.

Fourth, in a time when the sense of humanity and individual worth seems to be slipping away in a tide of rampant technology and bureaucratic indifference the interdisciplinary view can reestablish the human dimension.

Fifth, there is a widespread feeling that scientific analysis and technological growth are approaching some kind of a natural limit. We have the technical capability to do anything but what should we do? Interdisciplinarity may not provide answers but it does frame the questions.

Finally, the fact that interdisciplinarity has taken hold so rapidly in the centers and institutes that conduct basic research has serious implications for interdisciplinary planning in education. As these research efforts produce more and more knowledge cast in an interdisciplinary form the educational structure must find a place for it in the structure of learning.

We turn next to the caveats and problems arising from interdisciplinarity. Again this is a partial list with emphasis on contemporary issues mostly related to the process of activating the concept. Caution is certainly in order wherever an interdisciplinary approach gives a sign of injuring the vitality or compromising the effectiveness of the scholarly benefits of the disciplines; research, teaching, advising students. The cost of introducing interdisciplinarity to an operational state may well be too high in psychic disruption and intellectual slowdown. At least one analyst (Kavaloski, 1979) maintains that interdisciplinarity has no other course open than to compete with the disciplines, consequently it must be set asise unless a comprehensive reform is undertaken. A second note of caution is implicit in the CERI survey results. Persons associated with interdisciplinary programs tend to overanticipate the benefits and remedies it may offer compared to the shortcomings traditional programs display (Berger in CERI 1972).

Finally, from the inception interdisciplinary programs must be able to fulfill the professional needs of scholars who elect to affiliate with the experiment. In September 1979 a seminar of faculty and deans at the Pennsylvania State University addressed the question of what form a university-wide endeavor to develop interdisciplinarity might take. The two major difficulties that were quickly identified in

an otherwise favorable discussion were (a) the kind of organization best able to administer a program and (b) the weakness of such programs in supporting the scholarly efforts and recognizing individual achievements that are necessary for promotion and tenture. From this session emerged the penetrating observation that "present policies work toward the toleration of interdisciplinarity without giving nurture or encouragement to such efforts." Indeed, this may be the first condition, even the stable state, at most institutions.

C -- Operational Approaches to Interdisciplinarity: Illustrations and a Critique.

1 -- Organizational Forms for Experimentation.

From the beginning of the paper we have noted that the emphasis is narrowly instrumental with little attention to the epistemological or axiological matters that are so much a part of the dialogue on interdisciplinarity. What is required to operationalize interdisciplinarity in any form is an organizational vehicle, a device to hold the regrouped disciplines or reconstituted academic fields that are the first order outcome of interdisciplinary efforts. The most notable organizational forms are these:

a) Complete institution: The creation of a whole institution to nurture and serve interdisciplinarity was a reasonable dream in the nineteen sixties but it is unlikely that such a climate will reappear. The University of Sussex (England, 1962) provided a group of interdisciplinary schools now developed into a well rounded and still quite different institution. Evergreen College (US 1967) has a similar pattern but with less extension into research and faculty development. Green Bay (US 1965) built the institution on a major contemporary theme, ecology, and pivoted a variety of combinations on that focus.

The relatively narrow population base on which it depends and the fiscal problems of the state threaten the purity of concept now. Distinctive at Evergreen has been the attention to instructional forms.

b) Colleges within Universities: Most often the first two years are designated a "university college" and the general education concentrated in that time band. Within general education an option of interdisciplinary study is available.

c) "Phantom" Colleges: To avoid committing a full set of faculty, offices, laboratories, and classrooms the interdisciplinary aspects of general education are given to a dean and small staff. This office can contract and invite proposals from the disciplines to construct a coherent program of study. The University of Utah, Minnesota at Minneapolis, and Texas Technical College have variations of this form.

d) Satellite Location: By creating centers or institutes with designated responsibility for interdisciplinarity and then gradually investing them with educational responsibility, a gradual transition is achieved. The plan for Ghent, never implemented but reported in detail by CERI (1972) is an excellent example.

e) Enrichment Seminars: The weakest organizational form appears when a committee or council is given authority for short term interdisciplinary support. A period of time or series of events is identified as the interdisciplinary effort for the campus.

f) A quite different perspective on organizational forms is produced by the recent work of a doctoral student at the Pennsylvania State University. Baker (1978) examined a single type of interdisciplinary effort, environmental studies, across multi-national and multi-institutional

lines. The investigation found that international conferences and national convocations played a surprisingly strong role in getting programs underway. The case studies included programs at some of the major interdisciplinary institutions, Sussex, Paris VII (Étude du Milieu), Oxford (Human Sciences), and Australian National University. The data in Table 13 (Baker) give information about the organizational accommodations these programs have made.

Table 13

Program Sponsorship by Academic Administrative Unit

Administrative unit	Number	Percent
Departmental		
Environmental department	6	10
Discipline-based departments with environment designated programs	14	23
Discipline-based departments -- no special program designation	7	11
Interdepartmental		
Special interdepartmental structures -- environment designation	21	34
Other academic units		
College, faculty or school	7	11
College, faculty or school with environment designation	2	3
Institutes	4	6
Inter-institutional consortia	1	2

Further accommodation is revealed in Table 14 (Baker) which shows that the degree is often fitted into the existing structure rather than separately identified.

Table 14

Educational Outcome of Program: Field of Study in which Degree is Granted

Field of study	No. of programs	Percent
Agriculture	7	11
Architecture	1	2
Biological sciences	2	3
Engineering	4	5
Health sciences	1	2
Law	1	2
Social sciences	1	2
Environmental science	30	48
Applied sciences	1	2
Science	11	18
Arts	2	3
Arts or sciences	1	2

2 -- A Critique of Organizational Adjustments.

When the task of bringing an interdisciplinary endeavor into existence is made dependent on a new form of organization an interesting set of problems appear. They often remain even after the new unit is fully established. Because the unit is often completely new it cannot depend on any intuitive understanding from anyone, students, other faculty, the community, other institutions, and employers. It bears constantly the burden of explaining itself and in a sense justifying its existence. Second, these units are often joined with a single person or with a few enthusiasts whose presence is required to legitimate continuity. To institutionalize the innovation time and planning must go to the political processes at the expense of program development. Third, new organizations even when successful within their local environment often fail to articulate with other systems. Witness, for example,

the problems students encounter with the job market and graduate study. Faculty, too, feel the effects of marginal membership when they seek avenues of publication and professional participation. None of these criticisms offers an insurmountable obstacle but when taken together with the normal difficulties of program development they generate hazards to survival.

D -- The Curriculum Approach.

1 -- Having made rather briefly an argument that creating an interdisciplinary program by means of an organizational or structural change produces unnecessary hazards we now look at a more modest alternative. By focusing on the curriculum, the structure of program rather than the structure of organization, most of the benefits can be attained without generating excessive threats, confrontations, or competitions. Michaud (1972) has observed that interdisciplinarity is "not a sample question of curriculum." Perhaps it will never be a simple matter but in the introductory stages it can be <u>made</u> a matter of curriculum. Admittedly there is a need for more sophisticated understanding of what the concept of curriculum embodies and a need, too, for a better range of techniques in analyzing or planning an academic program but that can be achieved. In short, focusing the introduction of an interdisciplinary by means of curricular adjustment and innovation has one main requirement, an improved understanding of the concept of curriculum by faculty.

2 -- Treating the curriculum as a problem in design is hardly a self-evident suggestion and requires some elaboration. It has been customary to approach the curriculum either as an expression of a philosophic position or as the manifestation of a particular theory.

The commonest consequence of either approach is a long, long preliminary debate on basic positions, a debate which usually brings action to a halt and eventually brings the program down.

By moving away from the high abstract level of philosophy and coherent theory in psychology, for example, and moving into the concept of design the emphasis is shifted from premises to action. The concept of design comes to us by two principal routes, one from the world of art, the other from engineering. The engineering tradition pays particular attention to the refinement and accuracy of each of the components. These are put together in an arrangement that is governed by a set of formal propositions. Within any particular set of formal propositions the number of possible designs is limited. It is this technical approach to curriculum design that is most characteristic of current thinking. Great attention is paid to the design of courses, their content and presentation. They are carefully fitted together in a structure of pre-requisites and electives on the assumption that the total arrangement will carry its own impact.

The artistic tradition, on the other hand, deals often with the intuitive creation of a total composition. That composed form may be naturalistic, an attempt to represent a particular state accurately through an image, or it may be abstract in the sense that parts are desgined to convey a totality. A third and, perhaps, separate development of design has come from the study of information systems. A rich interpretation is found in the work of C. West Churchman, particularly in The Design of Inquiry Systems (1971). He observes; "It can be seen that design properly viewed, is an enormous liberation of the intellectual spirit for it challenges this spirit to an unbounded speculation about possibilities."

Nobel laureate Herbert Simon in the 1968 Compton Lectures developed the design concept quite fully in ways that are especially significant to the curriculum problem. "Engineers are not the only professional designers. Everyone designs who devises courses of action aimed at changing existing situations into preferred ones . . . . Design is the core of all professional training: It is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design" (Simon, 1969). He notes further, "Design . . . is concerned with how things ought to be, with devising artifacts to attain goals." The essential process is echoed in the lines of an artist, Christopher Alexander, in Notes on the Synthesis of Form (1964): Design is "the process of inventing . . . things which display new physical order, organization, form, in response to function." The notion of invention as opposed to discovery is really the crux of the argument developed so far. A theory of curriculum implies discovery: Curriculum as design implies invention. "The essence of the natural sciences is the discovery of hidden patterns or partially concealed ones." "Natural phenomena have an air of 'necessity' about them in their subservience to natural law, artificial phenomena have an air of 'contingency' in their malleability by the environment," (Simon, 1969).

If design is "the science of the artificial," what are its components; what is the essential process; and how do they fit curriculum analysis? From writers on both curriculum and design come a number of parallel terms which can be reduced to three main components. Broudy (1977) cites "form" and "content" as parts of the curriculum. Kaysen

(1973) select "content" and "context" as representative of curricular elements. Veysey (1973) separated the "formal structure" of the curriculum from the "substance of what is taught." All this meshes with the concepts developed by design theorists. Alexander (1964) speaks of "form" and "context," Simon (1969) uses the term "inner environment" to describe the substantive resources and limited "alternatives to action" they represent. The term "outer environment" describes the parameters or constraints within which they can be applied and the notion of "artifacts" designates the invented forms that link the two. Alexander (1964) writing from the perspective of the artist develops a similar terminology and relates the ideas in a particular way: "The form is part of the world over which we have control and which we decide to shape while leaving the rest of the world as it is. The context is that part of the world which puts demands on this form. Fitness is the relation of mutual acceptability between the two. In a problem of design we want to satisfy the mutual demands which the two make on one another." By integrating these varied expressions it is possible to define three basic components of curriculum design, content which describes resources available to the designer, context which includes the task definitions and constraints in the environment, and form the artifact developed to relate the other two.

The logic for the design process is suggested in the quotation from Alexander, above. The objective is a "goodness of fit," a congruence, between the artifact and the other two. Simon begins by noting that designers would like to optimize the relationship of content, context, and form but, "In the real world we do not usually have a choice between satisfactory and optimal solutions for we only rarely have a method of finding the optimum. . . we satisfice by looking for alternatives

in such a way that we can generally find an acceptable one after only moderate search."

To assist the process of developing "sufficient" as opposed to perfect solutions in complex situations the design problem is broken into sub-system" (Simon, 1969). The artist calls this a "hierarchy of concepts" (Alexander, 1964).

In summary, a unified description of the design concept can be developed as an analytical approach to the collegiate curriculum. The key concepts of CONTENT, CONTEXT, and FORM must be elaborated into a set of appropriate sub-systems preferably as a hierarchial structure.

.3 -- Illustrations of Curriculum Design Adjustments.

Briefly described below are recent efforts to introduce aspects of interdisciplinarity, often through the medium of general education. Some places the emphasis on FORM, others on a redefinition of CONTENT, and a few on CONTEXT.

a) Foundation Courses: In the early years of study the curriculum incorporates study units, often a series of courses, to provide an overview or conspectus, to introduce technique, or to set forth principles. Columbia University's venerable Contemporary Civilization program is the fullest development. The College of New Rochelle (New York) has adjusted both the CONTENT and the CONTEXT by offering team taught interdisciplinary courses like "the Human BOdy", they are distinctive in carrying the curriculum into the setting of a trade union center. Olympic College (Seattle, USA) has focused on two humanities courses and developed both CONTENT and FORM of presentation. Carnegie Mellon University (Pennsylvania, USA) has restructured the first two years

in the College of Humanities and Social Sciences around a core program that gives students wide choice.

b) Capstone Curses: Integrating courses at the end of the college career have been visible in the form of "honors programs" for fifty years. Worcester Polytechnic Institute (Massachusetts, USA) has introduced two projects at the senior year level. The Major Qualifying Project (MQP) requires intensive study into a problem area and demonstration of competence. The Interactive Qualifying Project (IQP) requires a study of interrelationships between science and humanity. Other collegs have quietly adopted a "senior seminar" that encourages an interdisciplinary approach to a topic of the student's choice.

c) Common program: Some of these follow a "core" pattern but others have an interdisciplinary theme through all the years of study. At Monterey Peninsula Community College (California, USA) the General Education Train of Courses, called GENTRAIN, offers a major interdisciplinary experience each year made up of courses, campus events, and visits. The distinctive feature is the creative nature of the experience for faculty who are selected for one year involvement. The CONTENT is new each year and extends from classical Rome to American Jazz. Portland State (Oregon, USA) has devoted six successive terms to team taught courses that weave interdisciplinarity around an historical core. The Allied Health School at University of Kentucky (USA) introduced a change in FORM by setting up student "study teams" that pursue their own pattern of selected courses.

d) Student choice: Aguments for an "open curriculum" are common in the literature of higher education but few institutions have tried them. Schoolcraft Community College (Michigan, USA) emphasizes

the development of intellectual skills by each student and the courses are instruments in the process.

e) Examinations and Degrees: Instead of working only with the CONTENT in the form of course presentations a rather large group of institutions is participating in the use of a new examination as the synthesizing experience. Under the guidance of the American College Testing corporation a major assessment of the outcomes of general education is underway, called ACT-COMP standing for "College Outcomes Measures Project" one phase involves a six hour battery of interviews, written papers, student prepared audio tapes, and a portfolio of work. So far it has been judged very effective by participants and consultants. To overcome the costs of time and personnel an attempt is now being made to prepare a test instrument (Forrest, 1977).

f) Topical Approaches: Often a beginning point is the enrichment of the curriculum rather than a modification to simply add-on an interdisciplinary demonstration.

At Southwestern Colorado (USA) the calendar has been changed to provide nine blocks of time each year. Part of the study options are oriented toward the Southwestern region and its history. At Metropolitan State College (Colorado, USA) a program with variable content emphasizes the cultivation of rational analysis. It is called STAR, "steps to Abstract Reasoning." Many institutions have adopted the "inter term" plan which allocates four to six weeks in the middle of the year to interdisciplinary projects. At University of California at Los Angeles the undergraduate student can choose a "thematic option" that will guide his or her planning through all the years of study.

Summary:

In search of a method to increase the power of educational experience for integrating student experience many scholars have turned to the idea of interdisciplinarity. Apart from questions of axiology and epistemology there are operational problems of some significance. To meet them many advocates have proposed modifications in the organizational structure of colleges and universities. The thesis developed in this paper argues that modifications in the academic program, the curriculum, are more appropriate. To achieve this curriculum modification, however, the design approach is strongly recommended.

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